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Theory, Practice and Policy: An Inquiry into the Uptake of HCI Practices in the Software Industry of a Developing Country

Abiodun Afolayan Ogunyemi [a], David Lamas [a], Emmanuel Rotimi Adagunodo[b], Fernando Loizides[c], and Isaias Barreto Da Rosa [d]

[a]Institute of Informatics, Tallinn University, Tallinn, Estonia; [b]Department of Computer Science and Engineering, Obafemi Awolowo University, Ife, Nigeria; [c]School of Mathematics and Computer Science, University of Wolverhampton, Wolverhampton, UK; [d]Information Technology and Telecommunication Commission, Economic Community of West African States, Abuja, Nigeria

ABSTRACT

With almost four decades of existence as a community, human–computer interaction (HCI) practice has yet to diffuse into a large range of software industries globally. A review of existing literature suggests that the diffusion of HCI practices in software organizations lacks theoretical guidance. Although many studies have tried to facilitate HCI uptake by the software industry, there are scarce studies that consider HCI practices as innovations that software organizations could or should adopt. Furthermore, there appears to be a lack of structure in the facilitation of HCI methodological development within the specialized emerging regions field such as Sub-Saharan Africa. In order to address this gap, an exploratory investigation regarding the state of uptake of HCI practices in Nigeria is conducted. The aim of this article is to improve our understanding regarding the state of HCI uptake in developing countries and the challenges prevailing. The findings show that HCI practice still remains within its infancy stage in most software companies. Universities are also lacking the required knowledge transfer of HCI to the students, and in effect themselves contributing to the lack of HCI skills in industry. Furthermore, government policies are in need of refinement and end-users' involvement in software development is not prioritized.

1. Introduction

Nigeria is a West African country with over 150 million people, and accounts for 20% of the African population (Hotez, Asojo, & Adesina, 2012). Nigeria is the largest economy in Africa[1] and 25th in the world. The economic capital is Lagos state (Aregbesola, Akinkunmi, & Akinola, 2011). Nigeria is on the 133rd position in the recent World ICT Development Index ranking and 14th in Africa.[2] Wireless broadband penetration is 10%, and approximately 33% of the residents are connected to the internet.[3]

The Nigerian software industry is still in its formative stage (Akinola, 2005). There are currently slightly over 100 software companies in Nigeria (Aregbesola et al., 2011). There are currently no recognized working standards regarding product development and most software companies use in-house methods (Soriyan & Heeks, 2004). There are many small companies and only a few of these focus on custom developments (Soriyan & Heeks, 2004). The capability maturity level of most of the companies remains at level 1 initially (Aregbesola et al., 2011).

Human–computer interaction (HCI) uptakes in developing countries are of two types: those, which are focused on domestic needs, and those tailored to international audiences. For example, most of India's software developments are for foreign customers (India is one of the destinations for lower development costs) (Smith et al., 2007). In Nigeria, most companies develop software for local needs (Soriyan & Heeks, 2004). Nigerian software companies might therefore have different practices or priorities and specific type of challenges.

Efforts to promote HCI-software engineering integration have been largely focused on the Western World. In a study on the state of agile usercentered design integration by Hussain, Holzinger, and Slany (2009), conducted with 92 practitioners drawn across the world comprising majorly usability professionals and developers, approximately 85% were from Europe and North America and just 3% were from Asia and 2% were from Africa.

For these reasons, in approaching this study, the Rogers' theory of diffusion of innovation (DoI) is used (Rogers, 2003), which has been applied both at the individual and organizational adoption levels, to explore underlying theoretical assumptions regarding HCI practice uptake in Nigeria.

According to a holistic understanding of the Rogers' DoI, HCI practice should be perceived as innovation.

CONTACT Abiodun Afolayan Ogunyemi abnogn@tlu.ee Institute of Informatics, Tallinn University, Narva mnt 29, Tallinn 10120, Estonia.

Color versions of one or more of the figures in the article can be found online at www.tandfonline.com/hihc.

[1]The latest World Bank's report (http://databank.worldbank.org/data/download/GDP.pdf) released on 14 April 2015 put Nigeria's Gross Domestic Product (GDP) at 521,803 (in millions of US dollars) and this accounts for slightly over 16.5% of Africa's total GDP of $3.139,033 (in millions of US dollars).

[2]This information is provided in the recent ITU report: Measuring the Information Society Report 2014.

[3]According to the recent United Nations' E-Government Survey 2014.

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Specifically, arguments that could be provided for why HCI practice should be perceived as innovation are (1) the field of software engineering began ahead of HCI, so it can be said that software engineering as a field has its own standard practice (Memmel, Gundelsweiler, & Reiterer, 2007); (2) the integration of HCI and software engineering has persistently been pursued since the early 2000s and has become systemic. Most of these efforts have been in the form of merging certain practices or frameworks in both fields (Joshi, Sarda, & Tripathi, 2010); and (3) there is still a dearth of HCI practitioners in the software industry and the bulk of people involved with software developments may have little or no HCI backgrounds. Thus, it is likely for software practitioners to perceive HCI artifacts or techniques as something relatively new to their practice.

In this work, an online survey of Nigerian software organizations was conducted to place the hypotheses and continued with 14 in-depth semi-structured interviews with several software practitioners, a policy-maker, an HCI academic, and two end-users. The goal was to determine the extent of HCI uptakes in software organizations in Nigeria and to gain insight into the challenges for human-centered design (HCD) practice.

The purpose of the study was to describe the HCI practice ecosystem in Nigeria and offer causal explanations that could help find possibilities for a strategic roadmap, necessary to facilitate uptakes of HCI practice such as the HCD in local software development companies in Nigeria and by extension in West Africa, Sub-Saharan Africa, and other developing countries. This work has the following three main goals.

(1) Describe the overview of the Nigerian software industry.
(2) Describe the extent of HCI uptake in the Nigerian software development industry.
(3) Identify the key challenges for HCD practice in Nigerian software companies (that can be present in other developing countries).

The article is structured as follows. In the next section, the reader is situated by providing the background to our study and theoretical approach. Subsequently, the methodology, followed by the results, is presented and a discussion is provided for the readers. Then the article is finalized with a proposal to facilitate HCI uptakes.

2. Theoretical Approach

The DoI theory (Rogers, 2003) has five communication channels, which are stages that innovations go through in order to spread. These channels are awareness, persuasion, decision, implementation, and confirmation. At the persuasion stage, there are five characteristics of an innovation, which influence its diffusion: relative advantage, compatibility, complexity, trial-ability, and observability (Rogers, 2003). However, the understanding of prior practice in the unit of adoption is required before proceeding with the communication channels (Sahin, 2006).

The key concepts in diffusion of innovations include the innovation (an idea, technology, or practice perceived to have better value than the status quo), and the key term in its definition is perception. An innovation could already exist but still be regarded as new; the "newness" of such innovation would now be related to the first three stages of the adoption process (Sahin, 2006). Other concepts include

(1) *Communication channels*: These are the means through which innovation gets to the receiver. The channels begin from the stage of awareness through to confirmation. Usually, communication takes place through these channels between sources. A source could be individuals or institutions and communication could spread through media such as TV, newspaper, radio, or interpersonal (Sahin, 2006). Interpersonal communication may be "homophilous," when two or more people who interact have similar attributes such as education, belief, and socioeconomic status, or "heterophilous," where the individuals differ in certain attributes (Sahin, 2006). It is also possible that communication channels are "localite" and "cosmopolite" in which there is communication between a member of a social system and an outsider. Nearly all mass media are cosmopolite channels, and interpersonal channels could be localite or cosmopolite. Because of these attributes, mass media and cosmopolite channels are more relevant to the awareness stage, and interpersonal channel to the persuasion stage of the adoption process (Sahin, 2006). Thus, one can assert that HCI publication resources such as application of HCI concepts, techniques, or methods in the software development process could be very significant to increasing the awareness of HCI practices. The extent to which software professionals access HCI results is, however, an arising important question.
(2) *Social system*: This refers to the group of individuals involved in the adoption process. A social system could be employees in an organization, organizations in an industry, or a country.
(3) *Change agents/agency*: Change agents are entities within a social system that advocate for an innovation, share its information, and provide support for implementation. The change support agency is an external body that provides support to change agents.
(4) *Opinion leaders*: These individuals influence adoption by promoting innovations they support in their community. They also influence rejection by spearheading criticism of innovations they refused to support. In some HCI studies, it has been reported that software engineers perceived HCI values and practices, such as user involvement, as unimportant. These studies described this perception as a "developer mindset" (Ardito, Buono, Caivano, Costabile, & Lanzilotti, 2014; Bak, Nguyen, Risgaard, & Stage, 2008).
(5) *Time frame*: This is the time span for an innovation to be adopted. Usually, adoption of innovation begins at a slow rate and increases gradually depending on

how effectively the communication channels are utilized. Uden, Francis, and Dai (2008) argued that the time frame for adoption could be influenced by three factors: innovation-decision process, relative time within which an innovation is adopted, and innovation's rate of adoption.

(6) *Adopter categories*: There are innovators, early adopters, early majority, late majority, and laggards.

The diffusion of innovations from innovators to early adopters is not always smooth. There exists a chasm between the early adopters who are intrigued by the prospects of an innovation and the early majority who demands for concrete evidences (Moore, 1991). The implication is that adoption could require a shift in the way an innovation is promoted (Quesenbery, 2000). For example, while trying to promote user-centered systems design, the need for "a profound shift of attitudes in systems development" and user involvement was identified by Gulliksen et al. (2003).

Chasm is not just to know where adopters belong but to also understand that certain issues might be lacking between two adoption categories, especially the one between the early adopters and the early majority (Moore, 1991).

2.1. Human-Centered Design Practice

The field of HCI has a broad goal to enhance and ensure the design and development of usable software products (Hochheiser & Lazar, 2007) by focusing on "user interface design (UID) issues such as ease of use, ease of learning, user performance, user satisfaction or aesthetics" (Gasson, 2003, p. 1).

The ISO 9241-210 framework for HCD specifies six important principles:

(i) The design is based upon an explicit understanding of users, tasks, and environments;
(ii) Users are involved throughout the design and development;
(iii) The design is driven and refined by user-centered evaluation;
(iv) The process is iterative;
(v) The design addresses the whole user experience (UX);
(vi) The design team includes multidisciplinary skills and perspectives.

The ISO 9241-210 framework describes the HCD as a framework, which allows wide participation from all stakeholders and not just the users, contrary to the traditional UCD (ISO, 2010).

The HCD approach places huge emphasis on the "multiplicity of relationships between the social system, the technology and organizational systems" (Gill, 1996, p. 3). HCD enables the users' active involvement, clear understanding, and task requirements thereby improving people's acceptability of new products (Liem & Sanders, 2011). HCD considers social constructs and provides a better approach for the design of software products for human use (Liem & Sanders, 2011; Majid, Noor, Adilah, & Adnan, 2012).

Challenges of Human-Centered Design Practice

Some challenges with HCD practice have been reported. For example, Postma, Zwartkruis-pelgrim, Daemen, and Du (2012) while engaging in empathic design in new project development (NPD) at Philips Research reported eight challenges relating to the discrepancies between theory of empathic design and its practice.

In conclusion, the authors came up with a proposal regarding cultural and methodological changes in order to address the challenges reported. The measures include a change of focus from rational approaches to empathic approaches, a change of focus from users as informers to users as partners when engaging in NPD, and a change of focus from being informed of user research to being engaged in user research.

Similarly, Steen (2008, p. 212) concluded that HCD is "a process that happens between people, a socio-cultural and political process, and a process with ethical qualities." Steen proposed that it should be understood that learning and creativity in HCD practice happen between people and not within one person, and such learning and creativity should happen in a face-to-face interaction in which people (researchers and designers) are open to one another and one can be questioned by the other.

The question is therefore raised: "What are the key contextual challenges for human-centered design practice in Nigeria?"

3. Methodology Overview

In this study, a mixed methods research approach is adopted in order to fulfil the research purpose. Quantitative data using the survey technique as well as qualitative data through interviews were obtained. This study is exploratory due to there being no previous knowledge of the state of HCI practice in Nigeria. Therefore, the survey is mostly descriptive and in order to deepen the understanding and to offer causal explanations qualitative interviews were conducted.

3.1. Survey of Companies' Representatives

Method and Procedure

The survey questionnaire consisted of 27 closed-ended questions adapted from the studies by Bygstad, Ghinea, and Brevik (2008) and Wechsung, Naumann, and Schleicher (2008). There were also five open-ended questions, which were meant to gain insights to specific HCI courses undertaken by respondents, a description of the ISO standards in use in companies, the HCI methods used in companies, the challenges for implementing HCD in companies, and suggestions from practitioners. A web-based survey was chosen in order to attract a larger number of respondents. The questions were designed in such a way that respondents only had to answer relevant questions. For example, a question asking a respondent to briefly describe a HCI course taken would not appear for a respondent that did not take an HCI course. Furthermore, some questions are multiple-choice type and allowed respondent to select more than one answer. The results from the survey were analyzed using descriptive

statistics. The unit of analysis is the software organizations in a developing country.

Participants

Software organizations were invited through a purposive sampling technique (Tongco, 2007) to participate in the survey. In Nigeria, although there are over 100 software companies (Aregbesola et al., 2011; Soriyan & Heeks, 2004), only a few focus on building locally written software (Soriyan & Heeks, 2004). Thus, our sample population consists of software companies that engage in building software from the scratch. Companies were invited through their mailing list, which was obtained from the Institute of Software Practitioners of Nigeria (ISPON) and other networking IT practitioners. Senior practitioners involved with software development in their companies answered the survey. Thus, the respondents were mainly project managers, designers, software engineers, and programmers. Table 1 shows the roles of the respondents. Other roles were CEO, technical resource engineer, and chief software architect

Sixty-seven companies participated in the survey, 37 organizations completed at least the first page of the questionnaire and the responses were used for demographic analysis. However, only 22 organizations completed the entire questionnaire and the responses were used to analyze HCD practice in the organizations. Thirty responses were not useful because they neither provided complete answers to the demographic questions nor answered the aspects regarding usability, UX, and HCD.

Table 1. Respondents' roles.

Respondent's role	Number of respondents based on demographic data	Number of respondents based on HCI practice analysis
System analyst	-	-
System architect	3	-
Usability designer	2	2
Programmer	13	7
Software engineer	6	5
UX designer	2	1
Project manager	5	3
Other	6	4
Total	37	22

Thirty-five of the respondents were male and two were female. The education profiles of the respondents are presented in Table 2 and show that the majority of the respondents possess a BSc degree. The majority of the respondents possessed a first degree in computer science. Twelve respondents (32%) indicated they took a course in HCI. Some of the descriptions are provided, for example, "The title of the course was Human-Computer Interaction"; "We were taken through the history of the concept and its evolution to this present day"; "We learnt the idea of making icons look like their real-life equivalents to make it easy to decipher"; "We were taught ergonomics"; "Covered just the basics of HCI"; "Visibility and Affordance"; "It involves the study, planning, design and uses of the interaction between people (users) and computers"; "Fundamentals of interaction design."

The description of the courses suggests these respondents were possibly more familiar with HCI concepts. For example, HCI concepts such as affordance and visibility as well as use of metaphors such as icons were indicated. However, none of the descriptions reveal other core HCI aspects such as HCI techniques and methods.

The years of experience of the respondents in their main roles suggest there were more practitioners with less than 5 years of experience. The majority of the respondents came from the information technology and software development sectors. It appears from our findings that small companies may be dominating the Nigerian software industry. This is consistent with a previous finding (Soriyan & Heeks, 2004). Table 2 is the overview of the respondents' profiles.

3.2. Interviews

Method and Procedure

In order to complement the survey, three exploratory case studies were conducted in three indigenous companies, and qualitative data were obtained using the interview technique based on the work presented in Yin (1994). An exploratory case study approach was used because there were no hypothesis to test. A similar approach has been used by Kuusinen, Mikkonen, and Pakarinen (2012). A previous study indicated development profile is very low in many software companies in Nigeria (Soriyan & Heeks, 2004). Another study indicated that most Nigerian software companies possess a capability maturity of level 1 (initial level) (Egbokhare, 2014). Thus, these reasons form the basis for the random selection.

Table 2. Participants and organizations' profiles.

Participants' profiles					
Educational qualifications	First degree disciplines	Main roles	Years of experience	Organization sector	Organization size (staff)
High school (3%)	Computer science (54%)	Usability designer (5%)	<5 years (57%)	IT services (41%)	Very small (10–20 staff) (49%)
Diploma (14%)	Software engineering (3%)	Programmer (35%)	5–10 years (19%)	Software development (41%)	Small (50–99 staff) (27%)
Higher diploma (8%)	Information technology (3%)	Software engineer (16%)	10–15 years (11%)	Telecoms (3%)	Medium (100–199 staff) (14%)
BSc (57%)	Other (10%)	UX designer (5%)	>15 years (14%)	Education (5%)	Large (200–499 staff) (3%)
MSc (14%)	N/A (30%)	Project manager (14%)		Government (3%)	Very large (500+ staff) (8%)
PhD (0%)		System architect (8%)		NGO (1%)	
Other (5%)		Other (16%)		Energy (1%)	
				Other (1%)	

Overall, 10 interviews in the 3 companies (5 interviews in Company A, 3 interviews in Company B, and 2 interviews in Company C) were conducted.

In addition to the 10 interviews, a representative from the policy-makers, an HCI educator in a local university, and 2 end-users were also interviewed. The policy-maker is the immediate past president of the ISPON. His selection was purposive as he had served in an advisory committee for the formulation of software policies in Nigeria, and has wealth of experience in the software industry. The HCI educator was selected because the research being reported was conducted in collaboration with his local university. The two end-users have experience with IT projects in their organizations and were found very relevant to the focus of the research. The principal investigator found the two end-users through personal networks. Thus, their selection was through a snowball sampling (Hussey & Hussey, 1997).

We analyzed our qualitative data using the content analysis technique described by Krippendorff (2003). The content analysis technique has also been used in a recent study in the HCI community (Law & Larusdottir, 2015). The process described by Krippendorff (2003) is exemplified in Figure 1, which shows an overview of the process of conducting content analysis.[4]

4. Results

In this section, the results of the online survey in two major aspects are analyzed. The first aspect deals with demographic data based on 37 responses. The other aspect deals with data on usability, UX, and HCD practice in the respondents' organizations. Only 22 out of the 37 responses were useful for this other aspect. However, the analysis of the interviews at the 3 companies and with the 2 end-users to strengthen the analysis of the 22 responses is provided. In Section 4.2, the analysis of the interviews with the policy-maker and HCI educator is provided.

4.1. Practice

Overview of Software Development Activities

Web developments appear to form the basic development activities in the Nigerian software industry as can be seen in Figure 2a. Most of the organizations tend to develop for clients (Figure 2b). Most of the organizations as well used the rapid application development (RAD) methodology (Figure 2c). Our figures also reveal that none of the software organizations used such methods as rational unified process, unified process, and V-model and spiral. Results also indicate that there are very scarce HCI practitioners in team compositions, and the major aspect prioritized in terms of HCI is that of graphic design (Figure 2d). Figure 2d is an overview of how teams are composed in companies, that is, people that might likely be found in a team.

State of HCI Practice

HCI awareness. Seventeen organizations (77%) indicate they are aware and five organizations (23%) are not aware of HCI. Although 17 organizations claim to be aware of HCI, the responses they provided to a question asking about the description of HCI methods applied in their companies do not support this claim. It appears only very few companies actually understood what HCI entails, based on how they described these HCI methods. Table 3 is the overview of their responses.

As can be seen from Table 3, the vast majority of the companies are very small and appear not familiar with the field of HCI. Only three of the respondents (Respondents 8, 9, and 15) described something relevant to our understanding of HCI methods/techniques. It could be that the newness of the introduction of HCI into few Nigerian universities' curricula is responsible for these results.

However, only 4 out of the 17 organizations, which are aware, accessed HCI results as presented in Table 4.

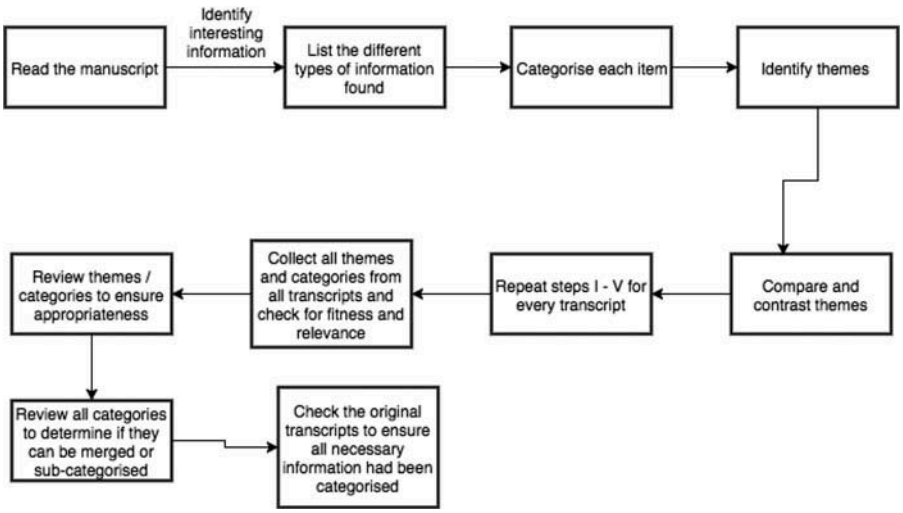

Figure 1. The content analysis process.

[4]http://libweb.surrey.ac.uk/library/skills/Introduction%20to%20Research%20and%20Managing%20Information%20Leicester/page_74.htm

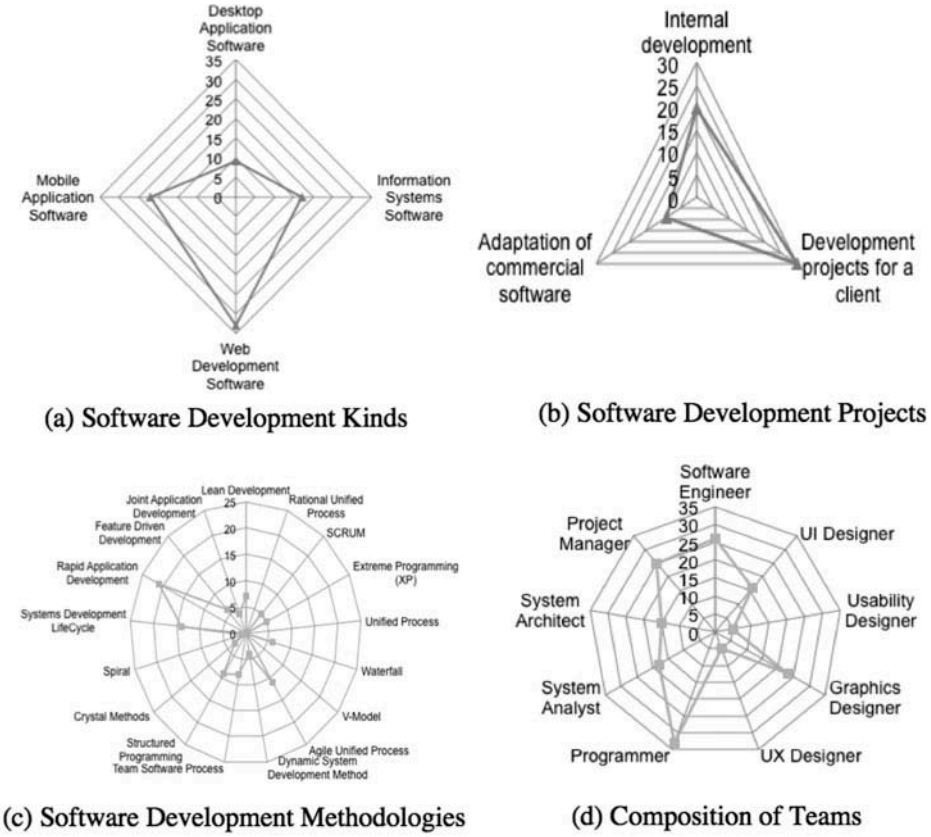

Figure 2. Software development profiles of respondents' organizations.

It is important to note that the respondents who assessed few of the sources presented in Table 4 are those who took a course in HCI and are all from small organizations. However, popular HCI result sources such as the ACM Digital Library and Taylor and Francis are not accessed. HCI publications are perceived to enhance software practitioners' awareness of the field of HCI and its activities. There could still exist a considerable gap between result and dissemination regarding HCI publications. A study by Jerome and Kazman (2005) revealed that HCI results have not reached the mainstream. It can be argued that HCI results have been implemented in companies such as Facebook, Google, Apple, LinkedIn, Microsoft, and IBM, but one must take into account that these are classified as large companies and multinationals rather than small- and medium-sized enterprises (SMEs) or national. According to the DoI theory (Rogers, 2003), there are just 2.5% innovators in the adoption categories and many very large companies and multinationals such Apple and Google are included. HCI has yet to diffuse into many small-to-medium-sized software companies (Bednarik & Krohns, 2015), especially those found in Sub-Saharan Africa, as can be seen also in this study. In a follow-up interview regarding access to HCI results, the reason why most of the practitioners do not access these HCI result sources might be due to their inadequate level of knowledge of HCI. One of the responses stated:

> "Well I think the major problem was that people did not have basic knowledge of HCI so you can't search what you don't know."

We provide further analysis by looking once again at the DoI theory. Beginning with how communication spread through the stage of awareness, as can be seen in this study, HCI publications are not accessed. Unlike developed regions such as Europe and America, it is a known fact that HCI has just been introduced in very few Nigerian universities. Furthermore, unlike countries where special interest groups such as ACM SIGCHI and IEEE ICSE have been used as venues to promote HCI practices in the industry, the same cannot be said of Nigeria. Currently, none of these interest groups exist in Nigeria and although there exist the ISPON and the Nigeria Computer Society, their programs are not geared toward introducing HCI approaches in companies. A study by Jerome and Kazman (2005) revealed that the vast majority of professionals involved with HCI aspects in the industry came to the awareness of HCI through interpersonal relationships. The same study also indicated that most of these HCI practitioners and software engineers developed their knowledge in HCI through informal means. In a similar study, Liu (2014) shared a personal experience on how he came to know about the field of HCI by reading a conference flyer and how he had developed HCI skills by reading online materials. Although part of these findings is similar to our results, the aspect of interpersonal relationships is still lacking in the Nigerian software industry ecosystem.

Change agents are very critical to facilitating uptake of innovations (Smith et al., 2007). Unfortunately, there are very few HCI practitioners (mainly graphic designers) in the

Table 3. Descriptions of HCI methods by respondents.

Company respondents	Roles of respondents in companies	Company size	Responses describing HCI methods used in companies
Respondent 1	Usability designer	Very small (10–20 employees)	I don't think I really understand this method
Respondent 2	Usability designer	Small (50–99 employees)	No answer
Respondent 3	Programmer	Very small (10–20 employees)	No answer
Respondent 4	Software engineer	Small (50–99 employees)	Tolerance, simplicity, visibility, affordance, consistency, structure, and feedback
Respondent 5	Software engineer	Very small (10–20 employees)	Interface designs
Respondent 6	Software engineer	Very small (10–20 employees)	The Star model
Respondent 7	Project manager	Medium (100–199 employees)	None at this time
Respondent 8	Programmer	Very small (10–20 employees)	Ethnographic method
Respondent 9	Software engineer	Large (200–499 employees)	User-centered design
Respondent 10	Programmer	Very large (500 employees and above)	Waterfall
Respondent 11	Software engineer	Small (50–99 employees)	None
Respondent 12	Programmer	Very small (10–20	None
Respondent 13	Technical resource engineer	Medium (100–199 employees)	The Waterfall model which takes into consideration the following phases: application description, analysis, design, and implementation
Respondent 14	Project manager	Very small (10–20 employees)	Various
Respondent 15	Project manager	Small (50–99 employees)	User characteristics analysis
Respondent 16	Programmer	Very small (10–20 employees)	No answer
Respondent 17	CEO	Very small (10–20 employees)	No answer
Respondent 18	UX designer	Very small (10–20 employees)	No answer
Respondent 19	Programmer	Small (50–99 employees)	Using existing system (ergonomic)
Respondent 20	Programmer	Very small (10–20 employees)	No answer
Respondent 21	Chief software architect	Medium (100–199 employees)	No answer
Respondent 22	CEO	Very small (10–20 employees)	Empirical approach

Table 4. Publication sources accessed.

Database accessed	Number of organizations
ACM Digital Library	0
IEEE Computer Society	2
IEEE Xplore	1
Taylor and Francis	0
Elsevier ScienceDirect	0
Springer Link	1
CiteSeerX	0
Wiley Online Library	1

industry and some of these practitioners have received only elementary (or even no) HCI knowledge. Thus, based on the level of their knowledge in HCI, it could be challenging to perceive these practitioners as change agents, who should advocate for introduction of HCI practices in their organizations or support implementation of such HCI practices, contrary to Vermeeren and Cockton (2013).

As regards opinion leadership, some studies revealed that quite often software engineers resist the introduction of HCI practices in their organizations based on their mindsets (Ardito et al., 2011; Bak et al., 2008). However, Bruun and Stage (2012) indicated it is possible to train practitioners to conduct a specific HCI practice they have earlier resisted. Specifically in the study, software engineers were trained to conduct usability evaluation. It should be noted that in some software organizations, software engineers make decisions as regards HCI aspects such as user interface design (Dighe & Joshi, 2014; Jerome & Kazman, 2005). Thus, it should not be taken for granted that HCI practitioners are actually people with HCI backgrounds, and this could be one of the challenges to the uptake of HCI practices in the industry. The Nigerian software industry does not yet benefit from opinion leadership to influence positively the uptake of HCI practices in organizations. None of the companies investigated can boast of greater works in HCI and could in no way provide leadership to other companies unless they first deal with their level of uptake and maturity internally.

Human-centered design practice. Similar to the study by Bygstad et al. (2008), it was desired to gain insights into the approach toward usability of interactive system development. The focus was particularly on usability testing, UX design, and prioritization of HCD in companies. First the priority for usability testing in companies was investigated. From the

data obtained, 12 organizations (55%) indicated they always conduct usability testing and 10 organizations (45%) indicated they sometimes do. In a follow-up question that allows multiple-choice answers, which did not appear for the 12 companies which claim to conduct usability test always, one of the primary reasons why usability testing is not always conducted within the 10 organizations is the time constraint (Figure 3a). In line with Figure 2c, it is possible that pressure of time is the major reason for the choice of RAD in the companies. RAD is particularly employed where organizations are constrained by a short time frame for software projects, cost, and need for quality (Agarwal et al., 2000).

It is possible these companies lack the awareness of the benefits of using low-cost methods such as user studies, contextual inquiry, affinity diagramming, ideation, personas, scenarios, prototyping, think-aloud tests, and performance test.

Respondents were also asked the kind of users selected for usability testing in their companies (Figure 3b). Eleven organizations indicate they use a representative sample of users for usability testing. Four organizations (18%) used their own employees, four organizations (18%) used their customer's employees, and three organizations (14%) used an arbitrary sample of actual users. These findings are similar to the findings of Bygstad et al. (2008), where 40% of the companies surveyed indicated they used representative sample of users. However, the analysis of findings of Bygstad et al. (2008) revealed that indeed companies did not select representative sample of users. Although the rule of thumb is to involve users that should be representative of the users of the intended system (Nielsen & Kaufmann, 1993), the question is about what constitutes as "representative" per system, especially in a country with massive population such as Nigeria? Thus, the term "representative" appears to be highly contextual. For example, in the study by Bygstad et al. (2008), the representative sample as indicated by the companies surveyed is less than 10 users.

We asked if the organizations address UX. Seventeen organizations (77%) were positive and five organizations (23%) indicated they do not address UX. The results in Figure 3c indicate that ease of use is prioritized more than other UX values. There could be few reasons for these results. First, the ITU 2014 report revealed that adult literacy rate in Nigeria was 51.1%. Thus, it could be that the level of knowledge of participants is the reason to prioritize ease of use in many projects. Second, the context of the project might make some values more relevant or more important than the others. For example, Figure 2a revealed that more companies are involved in web development projects, and ease of use is of utmost importance. However, as e-commerce is becoming a business trend in Nigeria, it is important that hedonic values, such as trust, are prioritized. The results show that pragmatic aspects of UX are prioritized by the organizations ahead of hedonic aspects such as fun/joy and helpfulness. These findings are also similar to the findings of Wechsung et al. (2008) and suggests that Nigerian software companies might not be involved in advanced UX works. Based on the ISO 9241-210 framework, usability is now subsumed by UX, and UX is subsumed by HCD (Law & Larusdottir, 2015). Thus, software development companies are expected to do more than just prioritizing pragmatic issues, which are defined in usability engineering.

Key Challenges for Human-Centered Design Practice in Nigeria

Four organizations reported they apply ISO guidelines for HCD and usability, 11 organizations reported they do not, and 7 organizations reported they are not aware of these ISO guidelines. When asked for specific ISO guidelines applied, only two

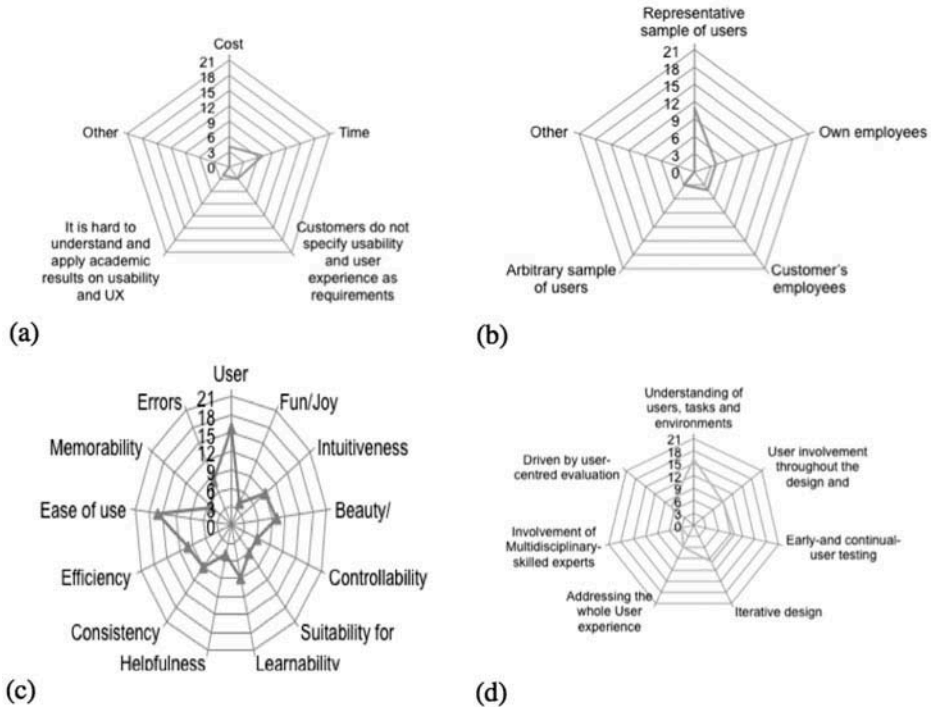

Figure 3. Usability practice, user experience, and approach to human-centered design in respondents' organizations. a) Usability testing constraints; b) Usability testing samples; c) Values prioritized in projects; d) Human-centered design principles prioritized in the companies.

organizations were familiar with the standards indicating ISO 9000 and 9241. The organizations were requested to select the principles for HCD, being applied by them, according to the ISO 9241-210 framework (ISO, 2010). The results obtained and presented in Figure 3d show the only aspect prioritized is the understanding of users, tasks, and environments. Other important dimensions such as user involvement and involvement of multidisciplinary-skilled experts and perspectives are less prioritized. Our results are similar to the study by Larusdottir, Haraldsdottir, and Mikkelsen (2009), which indicated that user involvement and involvement of HCI experts are not well prioritized in the Icelandic software industry.

Finally, some challenges (summarized in Table 5) suggest likely reasons for the choice of RAD in most of the organizations, as a respondent reported: "It's (HCI practice) time consuming."

However, it should be known from experience and previous work that organizations suffer when they substitute HCI aspects for time and cost (Gulliksen et al., 2003). Regarding HCI expertise, one of the respondents remarked: "We didn't have a good graphics designer." Another respondent corroborated by saying: "Little or no professional and even if there are, the company is not willing to pay for the service."

It is clear from the outcomes of the survey that many software companies in Nigeria probably are not familiar with the ISO 9241-210 on HCD or any similar standards. Very few are merely familiar with the ISO 9000 and ISO 9001 on quality assurance. A major challenge with ISO standards is that they have to be bought. The challenge is that standards that have been developed in the Western World have been practiced and refined through both experience as well as being promoted by leading industry companies. Their application to developing countries such as Nigeria is therefore resisted by the lack of the aforementioned reasons. The chasm that exists is that of the early adopters in the West and the laggards in many developing countries. As Quesenbery (2000) puts it, HCI practices especially UCD/HCD have not been presented in a way that meets adopters' (especially developing countries) needs. Another problem is the lack of maturity of existing tools, techniques, methods, and frameworks before new ones are introduced. The relevance of ISO 9241-210, for example, to many developing countries is questionable, as it can be seen from this study that most organizations are not familiar with the existing standards. Thus, given that HCI practices had been in existence for almost four decades in most Western countries, Nigeria is at a relatively early stage of uptake.

As this is a key point in the research findings that would assist in the further development of the HCI field within a developing country, more details and clarity to identify specific factors for the creation and uptake of HCI practices are probed. Next an analysis of the interviews of three companies and with the two end-users is presented. The companies are designated as A, B, and C in order to annotate the findings from the interviews. All the interviewees were senior staff and involved actively in their companies' development processes. The two end-users are designated as EUI and EUII.

Table 6 presents the overview of the three companies.

None of the three companies is a start-up. They all have been in operation for more than a decade. HCI is not yet a standard practice in any of the three companies, however, they are aware of HCI and used few techniques, albeit implicitly. The philosophy in all the three companies is that "less is better." This implies that a software solution should be kept simple and not intimidating or overwhelming for the user. Company C indicated that two types of projects are conducted and they are described as a "customer's project" and a "company's project." Company C describes a "customer's project" as the project in which the solution is built from the scratch based on the customer's requirement. A customer's project usually requires many design iterations because in many cases customers do not know what they want. A company's project is described as a project in which the solution has been semi-built by the developing company. Such projects are simply modified to suit the customer's requirements. Mock-ups are used in a company's project for the reason that most customers prefer what is already built (off the shelf) rather than bespoke. Furthermore, because customers often do not know what they want, designers make user requirement decisions to keep design iterations minimal. Only few clients produce detailed requirements. Thus, in many cases feedbacks are collected after product deployment and only used to enhance future releases. The indication is that most customers settle for a company's project. The approach used in company B is not different from the one used in company C. However, company A is mainly into software as a service and the approach is to allow some level of customization, such as themes, color regimes, which allows customers to brand their user interfaces.

The challenges the three companies faced in implementing HCD are identified:

(1) *A fit within a large spectrum*: Although all the companies have yet to integrate HCD in their processes, the challenge prohibiting small and medium companies regarding understanding user tasks and environment is the time it takes to undertake this principle. Many small companies have a small amount of staff who take on multiple roles. As indicated by all the companies interviewed, there is time and market pressure for small companies, as they have to deliver on time and on budget. Companies B and C report that clients appear to care less for HCD and there is no tool support in place to help these companies undertake the task of understanding the different users during product designs. In the medium company (A), there is a particular challenge to come up with a design solution that fits a large spectrum of

Table 5. Challenges indicated for human-centered design practice.

Challenges	Number of organizations	Percentage (%)
Lack of standard tools for integration	2	9%
Lack of knowledge of best practices	5	23%
Short time to deploy software projects	7	32%
Cost of hiring HCI experts	7	32%
Ineffective government policies	1	4%

Table 6. Companies' overview.

Company profiles	Description of activities at the companies		
	Company A	Company B	Company C
Size (number of employees)	Medium	Very small	Very small
Development culture	Off-the-shelf development	Custom development	Custom development and other software services
Year of establishment	1991	1998	2001
Motivation for development culture	Innovativeness, mastery, market leadership	Creativity	Survival strategy
Development focus	Financial and human capital solutions	Websites, e-commerce, e-learning applications	Websites, e-learning applications
Development model	Own method	Own method	Own method
Development team	In-house	In-house	Outsourced (team based abroad)
Software project type	Software as a service	Custom projects	Custom projects
International standards used	ISO 9001 (for quality assurance)	None	None
Product conceptualization techniques	Market survey, ethnography, and brainstorming	Brainstorming	Market survey
Product design techniques	Automation	Flowcharts, sketches	Rapid prototype, advanced prototype, wire framing, MVP, project scoping, documentation
Product evaluation and usability testing	Focus group (own employees with varying IT levels), stakeholders' meeting	Use of a dedicated server where customer can see and assess the project as it goes on	Rapid prototyping and continual testing with clients
Product maintenance/ continuous improvement	Customer survey, questionnaire, employees' appraisal, market survey	Market survey	Customer survey, questionnaire
Mode of communication	Emails, phone calls, face-to-face meetings	Face-to-face meetings	Video conferencing via Skype with the team based abroad and face-to-face meetings with the internal team
User value(s) prioritized in projects	Intuitiveness, ease of use, aesthetics	Ease of use, aesthetics	Ease of use, aesthetics, intuitiveness

users of off-the-shelf products. A strategy used in the company is to build a flexible and customizable solution, which allows users and companies to brand, choose their color regime, set their password policies, choose themes, etc.

(2) *User preference and not user involvement*: The three companies indicated that user preference for what is already built hinders involvement of users in product development projects. The problems with not involving users in development projects are jointly contributed by companies, customers, and the end-users. For companies, there is a perception that HCD is not realistic (A), a drawback (B), and not cost-effective for small companies (C). Sometimes, company A raises staff with varying IT skills to do focus group meetings and this is not the same as user involvement. For the clients, company B indicated that customers often divert all the responsibilities on development companies. For the end-users, preference for what is already made, inadequate IT knowledge (EUII), and inability to influence decisions in their workplaces discourage their involvement in projects. One of the end-users (EUII) reiterated his personal desire for what is ready to use. However, users often have bad experience with readymade software. EUII feels that building a product from the scratch and involving potential users is better. EUII remarked: "Assuming they built this software to what we want, we won't find it difficult to use."

(3) *User experience or customer experience?* Company B indicated that the lack of business case for HCD in Nigeria hinders its uptake in companies. It appears that UX is often subsumed by customer experience. Companies prefer to craft solutions for potential users based on identified needs, using techniques such as market survey. Therefore, the use of HCD methods such as participatory design, co-design, and empathic design is affected by a lack of business case for HCD. Company A considered UX design as "abstract" and company B described Nigeria as cynical to hedonic issues such as trust. Thus, the challenge to UX design is partly due to preference for customer experience, the Nigerian IT ecosystem, and companies' irresponsiveness to global movement. Core design strategy is giving confidence to the user. The design goal is to address a question: "What do I want to communicate to the user?" Consistence in design is a rule of thumb in company C. This is based on customer needs and project type. All the companies prioritized ease of use and aesthetics and ensure their solutions give ambience and confidence to the user. None of the companies however have a UX lab to conduct relevant UX tests.

(4) *Additional requirements and iterative development*: All the three companies used their own approach to iterate their design processes. In company C clients give a brief, fill a questionnaire, and provide their feedbacks. In company B, clients access products on

a live server and provide their feedback. In company A, however, company staff are formed into a focus group to interact with the product, identify challenges which are later filtered, and only feedbacks deemed "reasonable" are implemented.

Implementing additional requirements halt a project timeline in company B, caused by a lack of project documentation. This is common to many small companies in Nigeria (Egbokhare, 2014). Most often verbal agreement is reached with the client and the client refuses to pay for implementing additional requirements. It is suggested to the company to use the concept of *little design upfront* (Adikari, Mcdonald, & Campbell, 2009) and low-cost techniques such as prototyping and wire framing.

(5) *Responsive design not adaptive design*: In responsive design, one HTML document is served to many browsers and devices using fluid grids and media queries with a goal of ensuring that designs are flexible and accessible (Marcotte, 2010). In responsive design, a single template is used across devices, and makes a web page to load faster (Marcotte, 2010). However, the UX is limited by the choice of responsive design because some sites might be new and unique and require the application of adaptive design. In adaptive design, different templates and layouts are implemented depending on the device platform (Perkowitz & Etzioni, 1998). From the outcomes of the companies' interviews, all the three companies do responsive design. The outcomes indicate that responsive design is a survival strategy for small companies as revealed by companies B and C. However, the need for advanced UX design continues to emerge. Users want a particular color scheme, layout, webpage size, and fluidity. For example, EUI is an e-commerce user and indicated that an e-commerce site should provide basic values such as "user friendliness" and "trust."

4.2. Policy and Education

Software Development Policy

We conducted an extensive interview with the immediate past president of the ISPON. In 2011, the National Information Technology Development Agency produced a draft policy for software development in Nigeria.[5] The immediate past president of the ISPON contributed toward the development of the draft policy and the development of Nigerian local contents.[6] However, the policy failed to consider the aspects of end-users and customers' participation in software product development. Rather, the policy mandates software development companies to "Hold and maintain CMM or ISO 9001 or any other standard certification in order to qualify for large scale software development bids" (Section 11.2, Item 7). The interpretation provided is that organizational capability, maturity, and quality of software products are prioritized in order to qualify a software company for large-scale contract awards. Thus, our interview was partly focused on these policies, and partly on the state of software development practice in Nigeria. Five themes emerged from the interview.

- *Capacity for engagement*. The policy-maker indicated that the country lacks a share capacity for engagement and gave an example of an indigenous software company, which employed about 250 programmers. The development is conducted in Nigeria and the product is branded in the United Kingdom and sold to most developing countries.
- *Culture*. The policy-maker also indicated that the country has a culture of "watching trends" and running against technologies. There is also a culture of preference for foreign goods, which undermines local developments: "We are trend watchers."
- *Foreign exchange remittances on software*. The policy-maker expressed:

> "A lot of Nigerians want to buy foreign software whether it works or does not and they have to remit money in (American) dollars and that is one of the deficiencies of the market."

The policy-maker explained that such an act causes the depression of the local currency because it is not being used as the first currency of engagement. The policy-maker argued that in other developing countries such as India, the local currency is the first currency of engagement.

- *Road map for strategic development*. There is also an indication of the need for a blue print derived from a baseline study in order to get to a desired state of development. The policy-maker expressed: "We say a lot but we cannot do as much because there is no template for actions."

He explained further that there are no standards to emulate, and sustainability is lost. Furthermore, he argued against the relevance of the policy for software companies to have capability maturity. He believes CMMI is inappropriate for most African countries and would rather slow the pace of their development. The reasons are (i) CMMI had started a substantial amount of time before it was introduced to Africa; (ii) CMMI is not free and unaffordable to many small-to–medium-sized companies that also dominate the local industry in Nigeria; (iii) the presence and participation of multinationals in Nigeria disadvantage the local companies rather than motivate them, unlike China (Smith et al., 2007); and (iv) attainment of CMMI certification is not certifying products but organizations.

- *Academics and tools*. Universities are lacking good lecturers and trainers. Government requires collaborations and engagement of foreign expertise to attract to the

[5] http://www.nitda.gov.ng/documents/REV-NSP-BODY-PAGES2.pdf
[6] http://www.commtech.gov.ng/images/docs/ONCFramework2.pdf

country on a long-term project of building skills and knowledge in software engineering. A strategy is proposed where expatriates are employed on projects and distributed to schools beginning from elementary school to High Schools and through to tertiary institutions. The argument is that best practices are not best, but exemplary practice is. There are examples of Bill Gates of Microsoft and Mark Zuckerberg of Facebook who both quit university to become great innovators.

HCI Education

HCI education has just been recently introduced in few Nigerian universities.

The focus of the HCI course curriculum is usability. Aesthetics, context of use, and ease of use are also being taught. Universities face the enormous challenge of multidisciplinary skill acquisition by graduates because the Nigerian educational curriculum is designed in such a way that interdisciplinary education is not encouraged. For example, computer science graduate would proceed to masters in computer science, and then to a doctorate in computer science. Multidisciplinary skill acquisition is required in order to solve real-life problems. In other places, such as Europe and America where interdisciplinary education is encouraged, graduates are able to solve complex life problems. The field of HCI is multidisciplinary and it is important for experts to possess backgrounds such as psychology, computer science, and ergonomics. From the outcomes of our survey, it can be seen that companies merely prioritize values such as ease of use and user satisfaction. Although it could be that the context of the projects companies undertake and knowledge capability of the users are responsible for prioritizing ease of use and user satisfaction, the outcome of our interview within HCI education also suggest there is a limit to the knowledge of the professionals in companies.

There are also the challenges of little or no funding for labs, inadequate number of qualified HCI academics, and inadequate basic infrastructures such as electricity.

5. Discussion

We deduce several factors from the interviews with practitioners from the three companies and the two end-users, which limit uptake of HCI practices in the three companies.

(1) *Development standards*: All the three companies used their own methods and only company A compliments its development process by applying the ISO 9001 standards on quality assurance of software products.
(2) *End-users' involvement*: The challenges of user involvement are partly due to the lack of clear distinction between the client and the user. The primary purpose for user involvement in Nigeria seems to be the endorsement of a product. Companies do not know and use popular methods such as scenarios, personas, user studies, prototyping, ideation, and think-aloud tests, which are low in cost.
(3) *HCI expertise*: Although all the three companies are aware of HCI, as they strive to build intuitive and visually appealing products, the companies still lack the expertise to engage in more productive HCI practices. For example, the project manager in company A indicated: "We don't have a lab to say 'change the colour and see what people react to?' we don't do scientific experiments to decide what is the best colour scheme for this and that."
The chief technical officer in company C corroborated: "In trying to protect ourselves, we found ourselves implementing HCI." The insight drawn here is that HCI could be a disruptive practice for these kind of companies if they grow their maturity (Christensen, 2012). Although the companies appear to acknowledge the benefits of taking up HCI practice, they probably could face some kinds of disruption at a stage.
(4) *Lack of fit for small companies*: The ISO 9241-210 framework appears to be a misfit for small companies. Most of the companies surveyed have challenges with resource demands and expertise regarding adoption of the framework. Our finding is consistent with Bednarik and Krohns (2015). The Nigerian software industry still comprised predominantly of small companies. These small companies lack both the human expertise and capital to successfully adopt HCD. The issue of fit to small companies is perhaps not limited to HCD/UCD. For example, Bornoe and Stage (2013) conducted a study on some Danish small software companies and found that software developers lack the expertise to integrate usability engineering methods into agile practices.
(5) *Tacit knowledge*: Practitioners are not able to express what they do. This finding as well confirms existing literature that in some cases practitioners possess tacit knowledge and are not able to describe what they do in practice and in many cases, these practitioners are unaware they possess tacit knowledge (Ardito et al., 2014; Robinson, Segal, & Sharp, 2007).

The results from the survey are further explained by the outcomes of the interviews. The reason why companies do not prioritize HCD is because they are majorly very small to medium sized companies and are limited by finances, expertise, tools, and human resource required for implementing HCD. The major values prioritized in projects are ease of use and aesthetics. End-users also contribute to companies' lack of priority for HCD because they prefer what is already built. Thus, the Nigerian ecosystem requires HCI awareness to spread among end-users and customers and not just development companies. Regarding UX design, trust is one of the hedonic values that would be challenging for development companies. Nigerians tend to be cynical. Although the introduction of a cashless regime has paved opportunity for e-commerce to thrive, a study by Gholami, Ogun, Koh, and Lim (2010) concluded that trust is one of the factors affecting e-payment adoption in Nigeria.

The lack of proper formulation of policy geared toward empowering local companies and providing a robust platform to compete on a global scale also hinders the growth of the software industry in Nigeria. From the interview with the policy-makers, it can be inferred that government policies are flawed in areas raised in the interview. Based on their study, Tessler, Barr, and Hanna (2003) gave a case of the success of the Irish software industry where government played prominent roles by formulating effective policies, cooperating with multinationals, and strategic investment in software education in terms of domestication of knowledge.

The second issue raised was *culture*. The policy-maker observed that there is a *culture* of "watching trends and running after innovations" in Nigeria. In terms of adoption of innovations, laggards adopt based on necessity (Moore, 1991). Most of the companies merely respond to market pressures. As the CTO in company C puts it, when asked how they came to HCI awareness, "maybe the market taught us," there is also a lack of patriotism for local products as revealed in a study by Ofili (2014). However, Tessler et al. (2003) believe government can encourage export of software products by creating supportive regulatory environment for indigenous companies and promoting national ICT literacy. Tessler et al. (2003) argued that the government could intensify its role by "investing in government automation and e-government projects and adopting competitive procurement practices for software products and services."

There is a *lack of strategic roadmap for development*. The existing software policy in Nigeria does not provide a meaningful direction for successful software product development, rather the policy is focused too much on organizational capability. The policy-maker believed that capability maturity is a misnomer for Africa's development. Further, there was an indication of a lack of templates for actions, as most of the policies do not transcend documentation level. As the policy-maker argued, "We need to domesticate the knowledge. The maturity mode is about education maturity." Tessler et al. (2003) reiterate the need for government to domesticate knowledge by strategically investing in software education.

From the interview with the HCI educator, HCI was just introduced into very few (about five) Nigerian universities in less than a decade. The focus of the curriculum is still elementary and very theoretical. A similar situation was experienced in India (Smith et al., 2007). However, HCI awareness has only recently increased in many Indian software companies, although HCI has been around for a long time (Joshi & Gupta, 2011).

Unfortunately, as revealed from the interview with the policy-maker, Nigeria does not yet benefit from participation of multinationals in the local market. As indicated, these multinationals merely use Nigeria as a destination for selling their products while development work is done elsewhere.

There are no indications for advanced UX design activities. There appears to be a large neglect for usability testing and it is not done regularly due to time and cost factors. Software testing might also not be conducted holistically in many companies. Only company A indicated they do unit test, regression, integration, and quality assurance. A valuable insight from the policy-maker regarding software testing in the local industry is "Software testing is a normality abroad… it is not here because this is an individualized company concept in Nigeria. Over there you have an understanding of corporate entity and how it works, the law and regulations within the environment." It appears quality assurance testing is however prioritized ahead of usability testing. This finding is similar to the work of Larusdottir, Bjarnadottir, and Gulliksen (2010). Regarding UX practice, Moreno, Seffah, Capilla, and Sánchez-Segura (2013) argue that "an organizational change is necessary to align the software process with the design loops needed to properly address the user experience."

In comparison with innovation-driven countries such as Israel and Ireland, Nigeria is factor-driven. According to a recent World Economy Forum (WEF) global competitiveness report[7] Nigeria is classified still as a factor-driven economy. The basic requirements for a factor-driven economy are working institutions, infrastructure, macroeconomic environment, and health and primary education. Nigeria still battles with these basics according to the WEF survey. Both Israel and Ireland are destinations for outsourcing and specialized software developments (Deshpande, Richardson, Casey, & Beecham, 2010). The WEF survey described innovation-driven economies as those that encourage business sophistication and innovation. The Nigerian software development industry boasts of young professionals, which could be an attraction for foreign customers. Nigeria can provide enabling legislative and development environment for many start-ups and existing companies. Nigeria has the potential to become a destination for low cost and professional software development like India. However, as argued by Joshi and Gupta (2011), this opportunity cannot be fully realized without the role of HCI professionals in software development activities.

In comparison to other developing countries such as India and China where HCI practice is growing rapidly (Smith et al., 2007), the same cannot be said of Nigeria. India is also categorized as a factor-driven economy and China is efficiency-driven according to the WEF survey report. The difference between Nigeria and India, for example, is that the Indian IT industry has successfully evolved into a destination for special software development where most companies work in onsite-offshore engagement with the customers (Dighe & Joshi, 2014). Indian, Irish, and Israeli software industries are contributing to their national economies through high-volume exports of their software (Arora, Arunachalam, Asundi, & Fernandes, 2001; Tessler et al., 2003). The Nigerian software policy currently fails to consider the dimensions of HCI and would need to learn from the aforementioned examples of the countries.

At best, HCI is just at the awareness level in some Nigerian software development companies. Moreno et al. (2013) believe that consideration should be made regarding the trade-off between the potential benefits of HCI practice and costs of integration when considering promoting adoption of HCI

[7]See http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf

practices in software organizations. This view had earlier been expressed by Norman (1988). The question remains whether software companies and client organizations are prepared for this trade-off.

Overall, considering the experiences of India and China and innovation-driven economies such as Israel and Ireland, for example, uptake of HCI practices in the Nigerian software is hypothesized to take longer. Our reasons include the culture of running against technology, reacting to market forces and the lack of change agents and opinion leaders, and the elementary level of HCI education currently position the industry in the last adopter category, which are the laggards. Unfortunately, neither the universities' nor government's activities could currently provide the driving environment for the industry regarding uptake of HCI practices.

The outcomes of this study clearly indicate that based on the characteristics of adopter categories, the local software industry likely still belongs to the "laggards" category. According to Rogers (2003), adoption of an innovation usually begins with very few members of the unit of adoption and increases as more members come to the awareness of such innovation and are convinced of its benefits.

The first concern for an adoption is to figure out a business case for HCD. An adopting company needs to perform a cost-benefit analysis and modeling and involve the stakeholders in conceiving this business case. An assessment of a company's HCD maturity is, however, foremost when crafting a business case for HCD. Furthermore, companies need to collaborate with a successful company by benchmarking its development process. Local collaborations can happen between local universities and indigenous companies, and university-government partnership to explore and strengthen cases for HCD. Local universities can also partner with foreign universities in order to develop tools, techniques, and methods for HCD. Local universities can disseminate locally developed or adapted tools, techniques, and methods for HCD to indigenous companies by using avenues such as local conferences, SIGCHI, and mass media. Local companies can domesticate HCD knowledge by learning and re-learning, vocational training, knowledge creation, and sharing among team members. Finally, companies need to keep continual focus on the core principles for HCD when implementing in their processes. The business environment comprises the company implementing HCD, universities, and government. The HCD organization is the company implementing HCD.

5.1. Roadmap for Uptake of HCD

Based on the outcomes of this study, a roadmap that could be useful to facilitate uptakes of HCD in local software development companies is provided. The roadmap as presented in Figure 4 is a five-layer process.

6. Limitations and Further Work

The major limitation with this study is the sample size of our survey, which is a major challenge with online survey and administering questionnaires. The survey has been also narrowed to focus more on usability testing and not on other

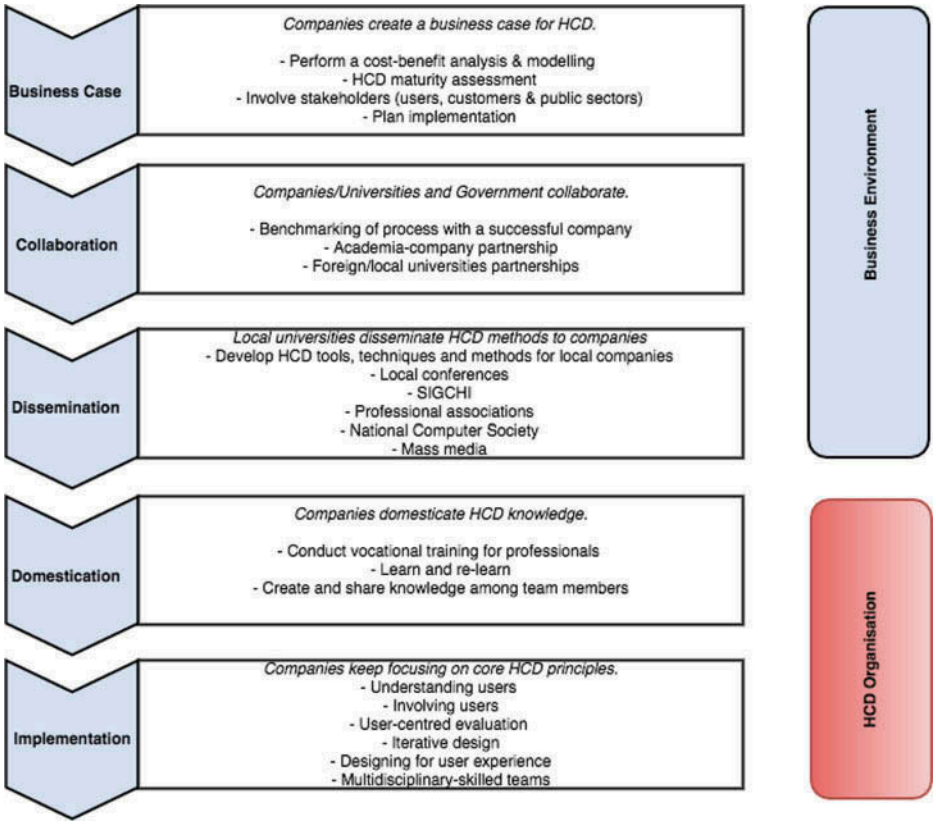

Figure 4. A roadmap for uptake of human-centered design practice.

important areas such as user requirements and iterative design, which are also crucial to the usability of interactive systems. However, valuable insights from the interviews in the three companies have been gained.

From the application of DoI to this study, an insight to justify that unless a drastic step such as working from within companies as change agents is taken have been gained, bearing in mind that adoption time is usually long, and HCI practice might continue to be elusive for many Nigerian software companies. In order to determine the actual state of HCI practice in small-to-medium-sized companies, this study is repeated in a developed country and the results are compared, and the possibility of developing a self-assessment tool to measure companies' human-centered development maturity and facilitate awareness of HCI is explored. Thus, it can be hypothesized that the use of a self-assessment HCD maturity tool could cause self-awareness, self-learning, reflective thinking, and process re-engineering among small-to-medium-sized companies and facilitate implementation of human-centered development.

7. Conclusions

This study reported a fieldwork investigation of the Nigerian software industry. Three issues were explored: the overview of the software industry, extent of HCI uptakes, and key challenges for HCD practice. Research was conducted through an online survey and semi-structured interviews. This study contributes to the literature regarding HCD implementation and diffusion of HCI into software development companies, especially those found in less-focused regions such as the sub-Saharan Africa. The conclusions drawn are itemized as:

(1) HCI is not yet well established in Nigeria. HCI is yet to diffuse into many small- and medium-sized companies. HCI research community would have to direct more research efforts on these sets of software development companies.
(2) There is no evidence based on previous studies and the outcomes of this study to suggest that HCI practice would advance in small- and medium-sized companies except if there were a strategic engagement with indigenous companies, especially small-to-medium-sized companies to introduce HCI methods, techniques, and tools and work collaboratively with companies.
(3) The current system of education in Nigeria does not encourage multidisciplinary knowledge acquisition among academics, and HCI practice in companies might continue to suffer some setbacks as a result of this.
(4) Even though these problems are overcome, the Nigerian market has to provide room for the development of business cases that would encourage the use of HCD methods. HCD, as argued by Venturi, Troost, and Jokela (2006), should be part of a business strategy.
(5) As the need to travel light has become pressing for many software companies (Memmel et al., 2007), HCD principles are not yet adaptive for factor-driven economies such as Nigeria. Very small companies dominate the software industry in Nigeria and these companies should be supported. Adaptive and discounted methods should be developed and diffused into this set of companies, so they could support local software development needs. Adaptive and discounted methods could as well leverage small-to-medium-sized companies on economies of scale of large companies through concepts such as "outsourcing."
(6) Regarding DoI categorization, the local industry in Nigeria is still lagging and cannot be compared with innovation-driven industries such as Israel and Ireland and fast-growing developing countries such as India and China.

As a way going forward, a roadmap that could help facilitate uptake of HCD practice in indigenous companies in Nigeria and other developing countries has been provided.

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ORCID

Abiodun Afolayan Ogunyemi http://orcid.org/0000-0002-1851-0442
David Lamas http://orcid.org/0000-0003-0295-453X
Isaias Barreto Da Rosa http://orcid.org/0000-0001-9721-4184

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About the Authors

Abiodun Afolayan Ogunyemi is a PhD student at Tallinn University, Estonia. He received a Master's in Information Systems from University of Cape Town in 2011. He has teaching and industry experience. His main research interest is HCI implementation, with a specialized focus on human-centred design implementation in software development processes.

David Lamas is a professor of Interaction Design and heads the HCI group and Master's program in Human–Computer Interaction at Tallinn University. He holds a PhD in Computer Science from Portsmouth University, UK. His main research interest is theory driven interaction design, with a special emphasis on distributed user interfaces.

Emmanuel Rotimi Adagunodo is a professor in the Department of Computer Science and Engineering at Obafemi Awolowo University, Ile-Ife, Nigeria. He holds a PhD in Computer Science from the same university. His research interests are in networking, distributed operating systems, and software engineering.

Fernando Loizides is Lecturer (Assistant Professor) of Computer Science at the University Of Wolverhampton, UK. His research lies in user experience and information architecture. He holds a PhD in Human–Computer Interaction from City University, London. He has published articles on digital libraries, information interaction, information architecture, and human-computer interaction.

Isaias Barreto Da Rosa is currently the ECOWAS Commissioner for IT and Telecoms. He was a Postdoctoral Researcher at Tallinn University and Assistant Professor at Jean Piaget University of Cape Verde. He holds a PhD in Education and Human Development (University of Santiago of Compostela), and a licentiate degree in Informatics (University of Lisbon).